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THE UNIVERSITY OF ALBERTA

AN INVESTIGATION OF DIFFERENCES IN INFERENCING BEHAVIOR BETWEEN AVERAGE AND LOW READERS

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "An Investigation of Differences in Inferencing Behavior Between Average and Low Readers" submitted by Dennis D. Schienbein in partial fulfilment of the requirements for the degree of Master of Education.

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ABSTRACT

This study examined the differences in inferencing behavior among average and low readers. Inferential responses were analyzed in order to determine developmental and process differences among three reading proficiency groups when attempting to comprehend written continuous narrative discourse.

For this study twelve grade four and twenty-four grade six students were selected from a population of 222 students in one large, suburban, elementary school. Subjects were screened for the study on the basis of General Comprehension scores attained on the New Developmental Reading Test, Form A (1968), and combined scores attained on the Canadian Lorge-Thorndike Intelligence Test, Form 1 (1967). Subjects formed three equal-sized groups with equal numbers of males and females in each group. An average grade four reading group, a low grade six reading group, and an average grade six reading group resulted from the testing.

Each subject took part in two inferential reading tasks. One task involved the production of an unaided recall after silent reading of a passage. The second task required subjects to respond to ten inferential questions. Subjects' responses were tape-recorded, transcribed into typed protocols, as well as analyzed using Schank's categories for inferences.

The statistical analysis of the data included a one-way analysis of variance and Scheffé multiple comparison of means.

Findings on the recall task indicated inferencing behavior did not discriminate between the average and low readers. A significant developmental difference was indicated for the quantity of backward-looking inferences produced, but no significant differences were noted for forward-looking inferences or textual constraint.

Findings on the inferential question task indicated that there were no significant developmental differences. In addition inferential behavior was similar for both low and average groups.

It was concluded that both average and low readers at the upper elementary level produce, store, and recall inferences as an integral part of their memory for written continuous narrative discourse. Implications for teaching were drawn from the findings and suggestions for further research were made.

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CHAPTER I

THE PROBLEM

Introduction to the Problem

Many prominent researchers and theorists in the area of reading see comprehension as the prime goal of the reading process (Smith, 1963; Goodman, 1972; Smith, 1975). Those involved with teaching children to read would generally agree with statements by writers such as Goodman (1972) when he says, "Meaning must always be the immediate as well as the ultimate goal in reading" (p. 155). However, such a broad definition of comprehension, as gaining meaning from print, is of little help to the classroom teacher required to teach children to comprehend. What is required is an identification of the processes involved in comprehension.

In an attempt to identify the various skills needed for comprehension, theorists such as Smith and Barrett (1974) have developed a taxonomy of subskills which they feel are involved in the comprehension process. They have identified literal recognition and recall, inference, evaluation, and appreciation as abilities students need in order to comprehend. Ruddell (1972) has also developed a taxonomy of comprehension skills and lists inferring beyond the given data as one of the skills necessary for comprehension. Davis (1968) and Pettit and Cockriel (1974) have done factor analytic studies into reading comprehension and identify two common factors. One is the understanding of what is explicitly stated by the author and the other is the understanding of information implied by the author which can be inferred by the reader.

Some research has been conducted into inferencing to determine if readers do in fact draw inferences as they read. Much of the research

has been done at the sentence level with adults (Bransford and Franks, 1971; Franks and Bransford, 1976), but some work has been done with children (Paris and Carter, 1973; Paris, 1975). Recently, researchers have moved from the sentence level to the discourse level, some using adults and some children (Paris and Upton, 1974; Thorndyke, 1976; McLeod, 1978). The consensus seems to be that individuals do in fact generate inferences as they read. Some writers (Paris, 1975; Thorndyke, 1976) suggest that inferences aid the recall of information and others such as Schank (1975) feel that inferences must be drawn if one is to understand what is being read.

Schank (1975), whose theoretical work is in the area of natural language processing, has suggested one possible way of classifying inferences. He suggests that inferences are either: (1) backward-looking where the reader must fill in "gaps" in order to comprehend sentences that follow; or (2) forward-looking where the reader may use one or more of the author's explicit ideas to generate an inference which deepens understanding, but is not essential for the reader to comprehend the passage. Schank also suggests that a reader must know when to stop making inferences and must base his inferences on the text.

From Schank's work it becomes obvious that if the reader is to draw inferences he must be actively involved with the print. The reader must be able to relate his background knowledge with the explicit information presented by the author. Thus, two sources of information are required in order to generate inferences. The one source is the printed page which gives a printed (visual) representation of the author's ideas, while the other source is the information the reader already has. Smith (1975) labels these two types of information as

"visual" and "non-visual" respectively, the implication being that one not only takes information from the page, but one must also bring information to the page.

A study recently completed by McLeod (1978) used Schank's classification system for inferences with proficient and very proficient readers as subjects. The study, among other things, points out the cognitive reality of inferencing as well as differences between the groups in terms of inferencing behavior. He suggests that further research is required using readers with average and below average reading ability and that the developmental aspects of inferencing be explored.

The present study attempts to compare the inferencing behavior of average and low readers in order to determine if inferencing behavior is one of the factors which differentiates among proficiency groups. In addition, it explores developmental aspects of inferencing behavior.

Purposes of the Study

The major purposes of this study are:

1. to compare average and low readers on the generation of inferences in the recall of written narrative discourse,
2. to compare average and low readers on the generation of textually constrained inferences from written narrative discourse,
3. to compare average and low readers on the generation of forward-looking and backward-looking inferences from written narrative discourse,
4. to compare average and low readers in performance on a questioning task requiring them to answer forward-looking and backward-looking inference questions within the constraints of a written narrative discourse,

5. to determine possible developmental differences in the inferencing behavior of two average groups of readers at different grade levels.

Definition of Terms

The following terms used in this study are defined as follows:

Reading Comprehension

A complex of processes involved in bringing meaning to the printed page and interacting with that written message in order to communicate with the author. (McLeod, 1978)

Written Discourse

A sequence of related sentences forming a story of 300 to 500 words.

Average Fourth-Grade Readers

Those subjects in grade four scoring between 4.85 and 6.14 on the General Comprehension score of the New Developmental Reading Test (1968), Form A.

Average Sixth-Grade Readers

Those subjects in grade six scoring between 6.44 and 7.94 on the General Comprehension score of the New Developmental Reading Test (1968), Form A.

Low Sixth-Grade Readers

Those subjects in grade six scoring between 4.85 and 6.14 on the General Comprehension score of the New Developmental Reading Test (1968), Form A.

Inference

The information generated by the reader based on explicit information provided in the context of the written text. The information generated by the reader was not explicitly stated in the text.

The following passage is included to provide examples for the remaining definitions.

We saw the Eskimos-Lions game yesterday. The Eskimos won on a dive play from the two with three seconds left. Afterwards they gave the game ball to the fullback.

Forward-Looking Inference

These inferences require the reader to use one or more explicitly stated ideas to go beyond that which was explicitly stated by the author. These inferences are not absolutely necessary to comprehend the text. An example from the above passage: The fullback may be carried off the field on the shoulders of his team mates.

Backward-Looking Inference

These inferences fill gaps between explicitly stated ideas and allow the reader to make sense of the explicit information. These inferences are necessary in order to comprehend the text. An example from the above passage: The Eskimos and Lions are football teams.

Textually Constrained Inference

These are inferences which are based on, and consonant with, the explicitly stated information in the text. An example from the above passage: A touchdown was scored. An example of an inference that is not textually constrained: The Lions and Eskimos are hockey teams.

Hypotheses

In order to achieve the purposes set out in this study, the following null hypotheses were formulated and tested.

Hypothesis 1

There is no significant difference among the three reading groups in terms of the quantity of inferences produced on the recall task.

Hypothesis 2

There is no significant difference among the three reading groups in terms of the quantity of forward-looking inferences produced on the recall task.

Hypothesis 3

There is no significant difference among the three reading groups in terms of the quantity of textually constrained, forward-looking inferences produced on the recall task.

Hypothesis 4

There is no significant difference among the three reading groups in terms of the quantity of backward-looking inferences produced on the recall task.

Hypothesis 5

There is no significant difference among the three reading groups in terms of the quantity of textually constrained, backward-looking inferences produced on the recall task.

Hypothesis 6

There is no significant difference among the three reading groups in terms of the quantity of textually constrained, forward-looking inferences produced on the direct questioning task.

Hypothesis 7

There is no significant difference among the three reading groups in terms of the quantity of textually constrained, backward-looking inferences produced on the direct questioning task.

Significance of the Study

Most remedial reading programs emphasize word identification and literal comprehension tasks. The assumption appears to be that low readers

will not be able to cope with the higher levels of comprehension such as inferencing until they have mastered word identification and literal comprehension skills. By providing reading material at or below instructional reading level, this study is able to compare the inferencing behavior of average and low readers without having word identification problems interfere with the inferential process. Results of this comparison will provide an indication of the validity of the above assumption and will either support the present emphasis on word identification and literal comprehension or will suggest that work on higher levels of comprehension be included as well. In addition, by comparing average and low readers on the nature of their inferencing behavior as well as the number of inferences they make, it should be possible to draw specific implications regarding the nature of the instruction required in both developmental and remedial programs. For example, Schank (1975) has suggested that readers must be aware of the constraints imposed by the text. The present study provides information on average and low readers' awareness of textual constraint. If differences exist, teachers may need to help low readers become more aware of the need for a balance between background knowledge and explicit textual material provided by the author.

The study also examines two average groups of readers at different grade levels in order to determine possible developmental aspects of inferencing behavior. Some research suggests that inferential ability increases with age. This study not only attempts to determine if there is an increase in ability to make inferences between grade four and grade six, but also attempts to investigate differences in the nature of inferential behavior at each grade level. The results should help to

indicate whether or not differences in instruction on inferential comprehension are needed at these two grade levels, and if so needed, should suggest what some of these differences may be.

Implications may also be drawn for producers of reading materials. If inferencing is a distinct subskill of comprehension then published materials will be required not only for developmental but remedial programs as well. These materials should provide materials which will extend the developing inferencing skills of pupils.

Limitations and Delimitations

The following limitations and delimitations should be observed when considering the findings of the study.

1. It is assumed that the subjects' performance on the tests and tasks used in this study is indicative of their ability on those factors that the tests and tasks purport to measure.
2. Many subjects may have been in an atypical reading situation as they may be unaccustomed to producing a retrospective unaided recall. The presence of a tape recorder and an unfamiliar researcher also placed the subjects in an atypical reading situation.
3. There was no attempt to control for the methods of reading instruction to which the subjects were previously exposed, and this may have been a significant factor in the subjects' inferencing behavior.
4. The study looked at only one selected classification of inferencing (forward-looking and backward-looking) with selected groups of readers. The inferencing behavior of these subjects cannot be said to be representative of fourth- and sixth-grade readers in general.

Plan of the Investigation

The investigation is reported according to the following plan. Chapter II will present a review of literature pertinent to the present study. Chapter III will describe the experimental design of the study. The data will be analyzed and discussed in Chapter IV. Chapter V will present a summary of the study, conclusions, implications for instruction, and suggestions for further research.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The main purposes of this study were to compare the inferencing behavior of average and low readers and to investigate developmental aspects of inferencing behavior. This Chapter presents selected theoretical works that point out that reading is a complex process involving two broad areas, namely word identification and comprehension. The theoretical work presented will deal mainly with the area of comprehension. Various theories will be presented that show comprehension is a complex process composed of several subskills. Particular emphasis will be placed on identifying a subskill which is common to most theories - namely inference. The second section will look at statistical studies which attempt to identify the component subskills of comprehension. The third section will present research into inferencing behavior. Research dealing with inference will be presented in two parts, the first dealing with inference at the sentence level and the second with inference at the discourse level.

Theoretical Work on the Subskills of Comprehension

Smith (1975) suggested that comprehension involves the relating of new information to that which is already known. Elkind (1976) also stressed that meaning must be provided by the reader from his background knowledge. Meaning is not inherent in graphic symbols. Most theorists take this view of comprehension that meaning is not inherent in the print. Rather the reader is as important to the reading process as the writer; the two must interact. In order that this interaction take

place, resulting in meaningful communication for the reader, various processes or subskills must be applied.

Ruddell (1972) has presented a taxonomy of comprehension skills which he feels are necessary if a reader is to get meaning from the printed page. The taxonomy has two major parts: (1) Experience and Memory, and (2) Critical Thinking. Under critical thinking he lists integrative skills which involve summarizing information. In order to summarize information a reader must be able to infer facts and ideas not explicitly stated in the text.

Smith and Barrett (1974) have also developed a taxonomy of reading comprehension. In their taxonomy they suggest four comprehension skills: (1) Literal Recognition or Recall, (2) Inference, (3) Evaluation, and (4) Appreciation. They indicate that inferential comprehension takes place when a student "uses a synthesis of the literal content of a selection, his personal knowledge, his intuition, and his imagination as basis for conjecture and hypothesis" (p. 64).

After expressing the opinion that comprehension has been neglected in reading research, Smith (1972) suggests four comprehension skills which teachers should attempt to teach. These are literal comprehension, interpretation, critical reading, and creative reading. She defines interpretation as providing meanings which are not explicitly stated in the text.

Other theorists (Gray, 1960; Jenkinson, 1957; Rystrom, 1970; Carroll, 1976; Guszak, 1978) also suggest that part of getting the author's intended meaning requires that the reader go beyond the explicit information given by the author.

Statistical Studies Into the Subskills of Comprehension

Working with college students, Feder (1938) attempted to delineate reading types and found, by means of factor analysis, that reading to infer and reading to locate information were independent processes.

Davis (1968) designed a test to measure eight skills that he felt were necessary for comprehension. Approximately 1,100 high school seniors were given the test. Responses were statistically analyzed to determine unique variances and the results indicated that, "Surprisingly large percentages of unique nonchange variance were found, especially in scores measuring memory for word meaning and drawing inferences from content" (p. 499).

After a review of the literature, Pettit and Cockriel (1974) noted that the majority of studies, while not agreeing on the specific types of comprehension skills, have found reading comprehension to be composed of two broad categories: literal comprehension and inferential comprehension. They designed a study using a sample of 533 sixth-grade students. The purpose of the study was to test specific skills within the categories of literal and inferential comprehension. In order to test the specific skills they used two tests designed by Pettit (1970): the Inferential Reading Comprehension Test (IRC) and the Literal Reading Comprehension Test (LRC). The IRC was composed of five specific skills and the LRC was composed of six specific skill areas. Subject responses yielded intercorrelations from .40 to .58 on the eleven subskills. They concluded that "these intercorrelations tend to confirm the independence of the scales, yet reflect positive correlations, suggesting that all reading skills tend to be correlated" (p. 68). As to the two broad categories of comprehension they concluded that factor analysis showed literal and inferential comprehension to be two distinct factors in reading.

From the preceding studies and theoretical writings one may conclude that reading comprehension is a multifaceted process. Two broad skill areas do seem to surface in the writings, namely literal and inferential comprehension. The attention of this study will now be directed toward examining the various studies which have been conducted into inferencing behavior.

Research Into Inferencing Behavior

The following section will examine studies that have explored the inferencing behavior of both adults and children. This section will be divided into two parts. The first will examine inferencing behavior at the sentence level with the second part looking at inferencing behavior at the discourse level.

Studies Conducted at the Sentence Level Into the Inferencing Behavior of Adults and Children

Bransford and Franks (1971) conducted a well-known study with adults at the sentence level. The study used fifteen first-year university students and attempted to ascertain how information from sentences is remembered. The researchers began with four complex sentences each containing four ideas. For each of the complex sentences they developed simple declarative sentences containing from one to three of the ideas contained in the complex sentences. Twenty-four of these simple declarative sentences were read to the subjects in a nonconsecutive manner with a color naming and question task interpolated between each acquisition sentence. After a five-minute rest period, the subjects were presented with twenty-eight sentences and asked to identify those they had heard before and rate the level of confidence for their response

on a scale of one to five. The twenty-eight recognition sentences contained only four sentences from the original list of twenty-four. As well, the recognition list contained the four complex sentences which the subjects had not seen during acquisition.

The researchers found that the complex sentences were identified the most often and with the highest rate of confidence even though they had not been presented with the original list of twenty-four sentences. Bransford and Franks concluded that the subjects were able to construct aggregate semantic ideas from pieces of information provided in individual sets of sentences. On the basis of this study one may conclude that the subjects were able to infer the interrelations among the individual sentences in order to construct holistic ideas.

Blachowicz (1978) investigated the comprehension of related sentences from which inferences could be produced. The subjects consisted of forty children from each of grades two, five, and seven as well as thirty graduate students. Each subject was asked to read ten paragraphs composed of three sentences whose lexical items were chosen from a list of words representative of second-grade reading materials. The paragraphs were then removed and subjects took part in a three-minute interpolated task. They were then provided with a list of sentences different from those found in the original paragraphs and were asked to mark them "yes" if they had seen them before or "no" if they had not. The recognition sentences consisted of true inferences, false statements, true statements, and false inferences.

Examination of the results showed a significant difference existed in the magnitude of errors with grade two pupils identifying more inferred recognition sentences as original sentences and the adults making the fewest misrecognitions. All age groups indicated a similarity in their

patterns of errors with each group "recognizing" a greater number of true inferences than false inferences, true statements, or false statements. Blachowicz concluded that subjects tended to "recognize" semantically similar inferences as original explicitly stated textual material.

The preceding studies indicate that adults, and in the case of the last study, children, can and do generate inferences when attempting to comprehend. The studies also indicate that comprehension is a constructive process which is aided by an ability to infer. The studies reported below have all focused on the inferencing behavior of children.

Paris and Carter (1973) used ten second-grade and ten fifth-grade students in their study. Each group contained five girls and five boys. The researchers were attempting to gain information on children's ability to infer information not stated explicitly in sentences. After the subjects had been told explicitly to remember the sentences, they were presented with a verbal acquisition list of simple declarative sentences. The sentences composed seven "stories" each of which contained three sentences. Immediately after the acquisition phase subjects took part in a five-minute block sorting task. During oral recognition, subjects were presented with four sentences related to each of the seven stories: a true premise, a slightly altered false premise, a true inference, and an invalid false inference. Subjects were asked to identify which of these sentences they had or had not heard before and rate the confidence of their response on a scale of one to three.

Results of the study showed that second-grade subjects made significantly more errors ($p. < .025$) than fifth-grade subjects and that all subjects identified true inferences as explicitly stated information heard previously. The results also indicated that there were no differences between boys and girls.

The findings of this study support the findings of Bransford and Franks with adults, that children could not differentiate new sentences from old ones. "Within this study, (Paris and Carter) subjects demonstrated the ability to implicitly and actively acquire, construct, and retain semantic information within sentences" (p. 112).

In an attempt to determine if constructive memory also occurred when the stimulus was a set of pictures, Paris and Mahoney (1974) designed a study using thirty-six grade two and thirty-six grade four students. Three equal sized groups were established within each of the grade levels. As with the Paris and Carter study there was an acquisition and recognition phase. One group of subjects from each grade was read six stories, each containing three sentences, and was read sentences during the recognition phase. The second group of subjects from each grade was shown pictures corresponding to the sentences and was read sentences during the recognition phase. The third group was presented pictures during both acquisition and recognition phases. A one-minute counting activity was interpolated between acquisition and recognition. The recognition test was composed of four sentences: a true premise, a false premise, a true inference, and a false inference. Subjects were asked to identify sentences or pictures that had or had not been presented previously and to rate the confidence of their response.

From their analyses they concluded, as had the Paris and Carter study, that "In the recognition memory task of this study, children had difficulty differentiating semantically consistent inferences from original sentences. The most plausible interpretation of this finding is that children implicitly constructed semantic relationships among sentences and integrated the relationships into holistic schemata in

memory" (p. 639). They also concluded that "Children did not store pictures as static, or eidetic copies, but, rather, it appears that subjects incorporated sequential visual relationships into unified representations" (p. 640). They further noted that subjects' performance did not vary as a function of sex.

The studies presented above dealing with children's inferencing behavior demonstrated that children, like adults, can and do generate inferences at a sentence level. The studies that follow will examine inferencing behavior of adults and children for continuous discourse.

Studies Conducted at the Discourse Level Into the Inferencing Behavior of Adults and Children

Thorndyke (1976) conducted two experiments to examine how readers use inferences to aid comprehension of connected discourse. The first experiment used twenty-four university students as subjects. The twenty-four subjects were divided into a control and an experimental group. Each subject was asked to read four passages with a mean length of twenty sentences. The passages contained two marked sentences and the subjects were to stop after each marked "target" sentence and write three inferences that might be drawn on the basis of the information to that point. Each passage also contained two marked "continuation" sentences that for the control group did not rely on an inference for understanding. For the experimental group the "continuation" sentence was written in such a manner that an inference between the "target" and "continuation" sentences was necessary in order to understand the "continuation" sentence. When the subject had responded to each of the passages, he was presented with a list of inferences for each passage and asked to rate the plausibility of each on a scale of one to seven. These

recognition inferences were of three types: an inference that was appropriate, an inappropriate inference, and a neutral inference that was not necessary for understanding.

Thorndyke found that for the control group there was no significant difference between the plausibility rating for appropriate, inappropriate, and neutral inferences. The experimental group, however, rated the appropriate inferences as most plausible and the inappropriate inferences as least plausible. There was little difference between control and experimental groups' plausibility ratings for neutral inferences. On the basis of these findings Thorndyke postulated that inferences produced during comprehension are stored in memory along with explicit textual information.

In order to test this theory, Thorndyke designed and conducted a second experiment where he also tested the idea that when subjects store an inference as part of their memory for a passage, they tend to remember the inference as part of the explicit information from the text rather than an inference.

This second experiment used a recognition test to assess the extent of contextual integration. Forty-eight university students made up control and experimental groups. The passages from the first study were used as stimuli. The control group passages had "target" and "continuation" sentences marked but no inference was required between the "target" and "continuation" sentence in order for the "continuation" sentence to be understood. For the experimental group an inference between the "target" and "continuation" sentences was required. After reading each passage, subjects were required to rate the story on three dimensions: comprehensibility, imagery, and meaningfulness. This rating

served as an interpolated task between stories. When all four passages had been read the experimenter read a set of twelve sentences for each story to the subjects. Six of the sentences were inferences and six sentences were from the story. Subjects were required to respond "yes" if they had heard the sentence before and "no" if they had not heard it.

Results of data analysis indicated no marked difference between the groups for recognition of sentences from the stories. The control group had no marked difference between inference types (inappropriate, appropriate, and neutral). For the experimental group there were differences at the .001 level between appropriate and neutral inferences and between neutral and inappropriate inferences. Thorndyke suggested that the production and recall of inferences played a major role in the comprehension of narrative discourse.

The studies reported above lend support to the importance of inference for comprehension of prose. They also demonstrate that adult readers can and do generate inferences as they read passages. However, these results cannot be generalized to the maturing reader. Studies by Paris and Upton (1974) and McLeod (1978) extend the work done with adults to children.

In order to explore the inferential behavior of elementary school-age children, Paris and Upton (1974) designed and conducted an experiment using twelve children from each of grades kindergarten to grade five. Each subject was read six paragraphs ranging in length from seven to nine sentences. After hearing each paragraph the subjects were asked to respond "yes" or "no" to eight questions. The eight questions measured four types of inferences. Two were labelled contextual inferences as they required the student to gather and amalgamate information from

several sentences. The researchers define these contextual inferences as "presuppositions, the pre-existing information necessary to make a sentence or paragraph true; and inferred consequences, the probable conclusion of a series of statements or conditions" (p. 232). The remaining two inference types were labelled lexical inferences as they depended upon a single word. These two types required subjects to infer that an object belonged to a larger class, and to infer an object which was necessary in order for a verb to complete a given action. The eight "yes-no" questions also included questions on explicit information.

The researchers found that inferential questions were responded to correctly more often than verbatim questions. The higher the grade the better subjects were able to correctly answer questions. Even after partialling out the effects of verbatim recall and separating effects of memory improvement from inferential operations, the results still indicated that inferential ability was significantly improved by development.

The preceding experiment was redone using sixteen students from each of kindergarten, grade two, and grade four. Four stories were read to the subjects and the questions were revised to include noun and verb categories. An unaided recall was also obtained after a ten-minute memory game was interpolated.

Findings for the question task supported the findings of the first study in that subjects demonstrated that age improved their ability to grasp inferential relations. The subjects also performed better on the inferential questions than the verbatim questions. Analysis of the free recall showed that grade level was the best predictor of performance on the unaided recall ($p < .01$), with responding to contextual inference ($p < .01$) coming next. Response to contextual inference was also the best

predictor of performance on unaided recall within grades.

Paris and Upton conclude that these results are "tentative evidence that children's ability to infer elaborate relationships such as presuppositions and consequences may be critical for the abstraction and retention of meaning from prose" (p. 239).

Prior to discussing McLeod's dissertation (1978) on the inferencing behavior of children, some of Schank's (1975) theoretical concepts concerning inferencing will be discussed since these are basic to an understanding of McLeod's study. Schank's theoretical work is in the area of natural language processing. He feels that the sentence has a dual role in the context of the paragraph. "It [the sentence] has the usual role of imparting information or giving meaning. In addition, it serves to set up the conditions by which sentences that follow it in the paragraph can be coherent" (p. 243). Schank also suggested that inferred information is as important as explicit information. In order to provide this missing information the reader must generate inferences. Schank classes inferences as either: backward-looking, which fill gaps between sentences and are essential if one is to make sense of the sentences that follow; or forward-looking, which are not essential for understanding, but tie together one or more ideas to allow the reader to go beyond the explicit information given by the author. A reader must also base his inferences on the text if he is to obtain the author's meaning and must also know when to stop making inferences. Schank's classification of inferences into backward-looking and forward-looking types provided a focus for classification of inferential responses for both McLeod's (1978) study and the present study.

McLeod (1978) explored, among other things, the inferencing behavior

of maturing readers at the fourth-grade level. The sample was comprised of forty fourth-grade readers, twenty of which were classified as very proficient readers and twenty as less proficient readers on the basis of scores on vocabulary and comprehension subtests of the Stanford Reading Achievement Test (1964). Each of the proficiency groups contained equal numbers of boys and girls.

After developing two equivalent continuous narrative discourse passages at the fourth-grade level, McLeod had each of the subjects take part in three inferential reading tasks. Each subject was presented with one of two passages as a stimulus for the inferential tasks. The first task, The Oral Reading Inference Task (ORIT), required that each subject orally read the passage. As he read he was asked to introspect and orally report his thoughts. For the second task, The Story-Recall Inference Task (SRIT), the subject was allowed to reread the passage and then asked to produce an unaided retrospective recall. The final task, The Directional Question Inference Task (DQIT), had the subject respond to ten inferential questions. These questions were developed using Schank's (1975) system of classifying inferences. Five of the questions required the subject to generate forward-looking inferences and five questions required the generation of backward-looking inferences.

Inferential responses for the ORIT were classified on two dichotomous levels: forward-looking, backward-looking; and textual support, non-support. Analysis revealed no significant differences between the groups in terms of the quantity of forward-looking or backward-looking inferences produced. For textual support the analysis revealed significant differences ($p<.038$) in favor of the very proficient group. A Signs Test was applied to compare within group differences. The results indicated that very

proficient readers produced significantly more forward-looking than backward-looking inferences, but the less proficient readers demonstrated no significant difference. When inferences were analyzed for textual support it was found that the very proficient readers produced significantly more supported than nonsupported inferences, but the less proficient readers showed no significant difference in this area. However, both groups did produce more supported than nonsupported backward-looking inferences.

Responses for the SRIT were analyzed using the following dichotomous levels: textual units, nontextual units; inferential units, other nontextual units; backward-looking, forward-looking inferences; and supported, nonsupported. Analysis of the data revealed no significant differences between the groups in terms of the type of inference generated or textual support. A Signs Test was used to determine within group differences on inferential behavior. The test revealed no significant difference in terms of the quantity of forward-looking and backward-looking inferences. A significant difference was revealed for textual support of both forward-looking and backward-looking inferences. Both proficiency groups produced more supported than unsupported responses for each type of inference.

From these findings on the ORIT and SRIT McLeod concluded that both reading proficiency groups produced both forward-looking and backward-looking inferences when reading continuous narrative discourse. The fact that very proficient readers produced more supported inferences indicates that they were better able to stay within the constraints of the text than the less proficient readers.

Analysis of the DQIT revealed that the very proficient readers produced significantly more backward-looking and forward-looking inferences

than the less proficient readers and also had significantly higher mean scores on textual support.

From the DQIT findings McLeod concluded that the performance of the very proficient group was significantly higher than that of the less proficient group on a structured task for both types of inferences. He also concluded that very proficient readers are more cognizant of the explicit information provided, and stayed within the constraints of the text when they produced inferential responses.

Studies into discourse comprehension suggest that readers are capable of drawing inferences while reading continuous discourse. They also indicate that inferences must be drawn if a reader is to construct the author's intended meaning, and McLeod's study has suggested that there may be differences in inferencing behavior among readers of different proficiency.

Summary

Reading comprehension is viewed as a complex cognitive process which requires that the reader use his background experience and knowledge as well as the print in order to construct an author's intended meaning. Theoretical views presented in this chapter suggest that an ability to infer is one of the subskills required for comprehension. Research at both the sentence and discourse levels with adults and children suggests that readers can and do generate inferences in order to reconstruct and retain an author's message.

As inferencing ability is suggested as an essential skill for comprehension by both theorists and researchers, and since little work has been done to examine differences in inferential behavior between average and low readers, particularly at the continuous written discourse level,

the present study will investigate differences among average and low readers in terms of inferencing behavior.

CHAPTER III

THE EXPERIMENTAL DESIGN

This chapter will describe the selection of the sample, the selection of testing instruments, the administration and scoring of the tests, and the coding and analysis of the data.

The Selection of the Sample

The purpose of this study was to ascertain possible process and developmental differences in inferencing behavior among three reading proficiency groups. The three reading proficiency groups were: (1) an average grade four group, (2) a low grade six group, and (3) an average grade six group.

The population for the study was drawn from one of the elementary schools assigned to the researcher by the St. Albert Protestant Separate School District Number 6. Officials indicated that the school served primarily middle-class families.

The initial test population consisted of eighty-four grade four pupils from three classrooms and 138 grade six pupils from five classrooms. The test population was administered the New Developmental Reading Test, Form A (1968).

To obtain subjects for the average grade four and low grade six groups the results on General Comprehension from the New Developmental Reading Test were surveyed. Grade scores for the grade four group ranged from 3.1 to 8.7, with a mean on General Comprehension of 5.47, and a standard deviation of 1.28. Twenty-five fourth graders had scores within one standard deviation of the mean, grade 4.85 to 6.14, and nineteen sixth graders also had grade scores within the same range, grade 4.85 to 6.14.

The twenty-five fourth graders and nineteen sixth graders with General Comprehension scores within one standard deviation of the grade four mean were then given both the verbal and nonverbal sections of the Canadian Lorge-Thorndike Intelligence Test, Form 1 (1967). The Lorge-Thorndike Intelligence Test was given to eliminate subjects at the extreme ends of the scale on intellectual ability. Students who scored below 83 and above 113 were eliminated from the study. Those students with known vision and hearing problems, or those judged by classroom teachers as not being fluent English speakers were also eliminated from the sample. As background experience is essential for generating inferences, any subjects who had repeated a grade were also eliminated from the study as it was felt that repeating a grade would give them more experiential background information than nonrepeaters.

Twenty-two grade four students met the above criteria, and twelve were selected, six boys and six girls, to form the average grade four group. Table 3.1 indicates the General Comprehension score on the New Developmental Reading Test, Form A (1968), the score on the Canadian Lorge-Thorndike Intelligence Test, Form 1(1967), the sex, and chronological age for each subject in the average grade four sample. The mean chronological age for the group was 9.98 years.

A low grade six reading group was included in the study for the purpose of comparing inferencing behavior between two reading groups similar in reading achievement and intellectual ability, but differing in grade level. For this reason grade six subjects were selected who had a General Comprehension grade score between 4.85 and 6.14, and an intellectual ability score between 83 and 113. Thirteen grade six students met the above criteria and six boys and six girls were

TABLE 3.1

BACKGROUND INFORMATION ON AVERAGE GRADE FOUR SUBJECTS

Subject	Sex	General Comprehension Score	I.Q.	C.A. (April, 1978)
01	F	5.6	101	10.1
02	F	5.7	99	9.2
03	F	5.0	93	11.0
04	F	6.1	104	10.75
05	F	5.7	89	9.8
06	F	5.3	92	9.6
07	M	5.6	102	10.1
08	M	5.1	95	10.1
09	M	5.9	92	9.6
10	M	6.1	105	9.9
11	M	6.0	83	10.25
12	M	5.5	93	9.4

selected to form the low grade six group. Table 3.2 indicates the General Comprehension score, the intelligence test score, the sex, and chronological age of each subject in the low grade six group. The mean chronological age of this group was 11.92 years.

Results on General Comprehension from the New Developmental Reading Test were surveyed in order to obtain subjects for the average grade six group. Grade scores for the total grade six group tested ranged from 3.6 to 10.3, with a mean of 7.18 and a standard deviation of 1.50. Thirty-nine sixth graders had scores within one standard deviation of the mean, 6.43 to 7.93. These thirty-nine students were then given the Canadian Lorge-Thorndike Intelligence Test, Form 1 (1967). Those subjects scoring below 83 and above 113 were eliminated from the study. Again, any subjects with known hearing or vision problems, those judged by their teachers to be nonproficient in the English language, or those who had failed a grade were eliminated from the study. Twenty-four subjects met the above criteria, and from this group six boys and six girls were selected to form the average grade six group.

Table 3.3 indicates the General Comprehension score, the intelligence test score, the sex, and chronological age of each of the average grade six subjects. The mean chronological age of this group was 11.91 years.

A one-way analysis of variance on the variable of intelligence was computed to determine whether or not the sample groups came from the same population. The results indicated that the three groups did not differ significantly and therefore did not represent different populations. A summary of this analysis is presented in Table 3.4.

A one-way analysis of variance was also computed on the variable of reading achievement to determine whether or not the sample groups came

TABLE 3.2

BACKGROUND INFORMATION ON LOW GRADE SIX SUBJECTS

Subject	Sex	General Comprehension Score	I.Q.	C.A. (April, 1978)
13	F	5.7	100	11.8
14	F	5.6	96	11.75
15	F	5.1	102	11.6
16	F	6.1	95	11.8
17	F	5.7	87	12.1
18	F	5.8	83	12.6
19	M	5.5	99	11.8
20	M	5.4	94	11.5
21	M	5.5	98	12.2
22	M	6.1	107	12.0
23	M	6.1	88	12.4
24	M	5.2	86	11.5

TABLE 3.3

BACKGROUND INFORMATION ON AVERAGE GRADE SIX SUBJECTS

Subject	Sex	General Comprehension Score	I.Q.	C.A. (April, 1978)
25	F	7.7	101	12.25
26	F	7.9	98	11.5
27	F	7.6	99	12.0
28	F	7.7	93	12.2
29	F	7.0	88	11.6
30	F	7.8	92	12.25
31	M	7.3	104	11.8
32	M	7.6	96	12.4
33	M	7.9	98	11.9
34	M	7.3	97	11.6
35	M	7.3	90	11.5
36	M	7.3	92	12.0

TABLE 3.4

ANALYSIS OF VARIANCE: COMBINED INTELLIGENCE QUOTIENTS FOR THE THREE READING GROUPS

Source of Variation	Sum of Squares	Mean Squares	Degrees of Freedom	F-Ratio	Probability
Between Groups	9.375	4.69	2	.12	.88
Within Groups	1310.312	39.71	33		

$F_{.95}(2, 33) = 3.29$

from the same population. The results of the analysis indicated that there were significant differences among the groups at the .01 level. A summary of the analysis is presented in Table 3.5.

As this analysis indicated there was a significant difference at the .01 level among the three groups, the mean scores for each group were compared, using the Scheffé multiple comparison of means to find where this difference lay. The analysis showed that the average fourth graders and the low sixth graders came from the same population ($p = .99$), while the average sixth graders represented a different population ($p = .0$).

Testing Instruments

Results from two standardized tests were used in this study: the New Developmental Reading Test (Bond, Balow and Hoyt, 1968, Form A) and the Canadian Lorge-Thorndike Intelligence Test (1967, Form 1).

In order to obtain a measure of each subject's reading achievement the New Developmental Reading Test, Form A, was used. The test yields five subtest scores: a vocabulary score, a reading for information score, a reading for relationship score, a reading for interpretation score, and a reading for appreciation score. As well the following three combination scores may be computed: literal comprehension, by combining reading for information and reading for relationships; creative comprehension, by combining reading for interpretation and reading for appreciation; and general comprehension, by combining the previous two combination scores. The test has two forms. It was normed using fifteen thousand pupils from urban and rural communities in seven geographical areas of the United States. The alternate form reliability of the subtests and combination scores ranges from 0.77 to 0.91, while the internal consistency reliability ranges from 0.80 to 0.94. Grade

TABLE 3.5

ANALYSIS OF VARIANCE: READING ACHIEVEMENT SCORES
FOR THE THREE READING GROUPS

Source of Variation	Sum of Squares	Mean Squares	Degrees of Freedom	F-Ratio	Probability
Between Groups	2862.875	1431.44	2	130.36	.0
Within Groups	362.375	10.98	33		

$F_{.99}(2, 33) = 5.33$

equivalents on the General Comprehension score were used to select the subjects to be included in the sample.

To obtain an indication of each student's intelligence the Canadian Lorge-Thorndike Intelligence Test, (1967, Form 1) was used. The test has a nonverbal battery containing only pictorial or numerical items and a verbal battery consisting only of verbal items. The subjects were given both batteries of this test. The test was normed on a stratified random sample of 31,739 pupils in grades three to nine from across Canada. Odd-even reliability for levels A-F of the verbal battery ranges from 0.830 to 0.945, while for the nonverbal battery it ranges from 0.894 to 0.931. The intercorrelations between the verbal and nonverbal batteries for levels A-F are reported from 0.558 to 0.681. The manual notes that, "Correlations of the Verbal Battery with Stanford Binet and with the WISC Verbal Scale have been reported in the high seventies and low eighties. The Nonverbal Battery correlated somewhat lower with these same tests - in the high sixties and low seventies" (p. 29).

As well as the above tests, two passages and two inference tasks developed by McLeod (1978) were modified for use in this study.

In order to develop his two passages, McLeod first determined that presently used reading texts, in the province of Alberta, required pupils to answer both forward-looking and backward-looking inference questions. He then developed nine passages patterned after selections found in Reading Progress, Book 4 (Quick, 1961). The Dale Chall Readability Formula (Dale and Chall, 1948) was used to ensure a standard level of difficulty. Each story was also analyzed according to a modification of Rumelhart's (1975) story grammar in order to compare the internal structure of the stories. Two of the nine stories were

dropped on the basis of this analysis and a further story was deleted as a result of a preliminary pilot study. The main pilot study had pupils rate the stories for interest and McLeod examined student achievement on answering inference questions. Three of the stories were dropped because of low mean achievement on the inference questions and the lack of interest expressed by the students for the stories. A fourth story was deleted as two students achieved perfect scores on the inference questions. The remaining two passages, "Miss Bella's Plan" and "Scotty Becomes A Hero" were used in his study and may be found in Appendix A of this study. The Dale-Chall formula rated the stories at grades 4.8 and 4.7. Analysis of the two stories using a modification of the Rumelhart story grammar showed similar story structures.

Two inference tasks developed by McLeod (1978) were modified for use in this study. The Story Recall Inference Task (SRIT) required students to silently read one of the stories. After the story had been read, it was removed and the student was asked to provide an unaided recall of the story. When the subject finished, the investigator asked "Is that what you remember?". The SRIT was used to determine if the different reading groups differed on the quantity and quality of inferences generated on a comprehension task. Research had suggested that inferences were stored and recalled as part of the representation of a reading experience. While the presentation of the SRIT was the same for this study as it was on McLeod's, it should be noted that in McLeod's study subjects had previously read the story orally to the investigator and received some instruction on inferencing.

McLeod's (1978) Directional Question Inference Task (DQIT) was also used in this study with some modification. After completing the SRIT, the

story was returned to the subject who was asked to respond orally to five forward-looking and five backward-looking inference questions. The subjects were told that they could refer back to the story to answer the oral questions. The purpose of the DQIT was to compare the inferencing behavior of the groups in a structured situation. Sixteen of the twenty questions on McLeod's DQIT were retained for use in the present study. The remaining four questions were changed as this researcher felt they did not require inferential responses or were difficult to score objectively.

Inter-rater reliability was sought for the twenty questions used on the modified DQIT. The Arrington Reliability Formula (Feifel and Lorge, 1950) was used to compute the reliability score.

$$\left(\frac{2 \times \text{Total of Agreements}}{(2 \times \text{Total of Agreements}) + \text{Disagreements}} \right)$$

A graduate student in reading, and a classroom teacher rated the twenty questions. The formula yielded a reliability score of .96. Both the forward-looking and backward-looking inference questions are included in Appendix B.

Administration of the Instruments

Four of the five subtests of the New Developmental Reading Test, Form A, were administered on April 24, 1978. The researcher and an outside classroom teacher administered the tests to the eight classes. Class sizes ranged from twenty-six to twenty-nine students. The testing consisted of four ten-minute timed subtests which were administered according to manual instructions.

Both the verbal and nonverbal batteries of the Canadian Lorge-Thorndike Intelligence Test, Form 1, were administered on May 1 and May 2, 1978. The test was administered according to manual instructions, and all tests

were administered by the researcher.

The Story Recall Inference Task and the Directional Question Inference Task were administered between May 5 and 8, 1978. These tasks were all administered by the researcher and were conducted individually with each subject in a room provided for this purpose by the principal. Passages were randomly assigned so that half of each group read "Miss Bella's Plan", while the other half read "Scotty Becomes A Hero". Both the SRIT and DQIT were tape-recorded using a Sears model 19038 cassette tape-recorder. Each subject was read the directions for each of the inference tasks and additional explanations were provided when needed. After silently reading the story, the selection was removed and the subject provided an unaided recall of the story. When each subject finished, the investigator asked, "Is that what you remember?". To complete the DQIT the selection was returned and each subject was asked five forward-looking and five backward-looking inference questions. Complete directions for the SRIT and DQIT are included in Appendix C.

Scoring of the Instruments

The New Developmental Reading Test was scored by the researcher according to the keys provided by the publisher. Raw scores were computed for each of the four subtests given, as well as the three combined scores of Literal Comprehension, Creative Comprehension, and General Comprehension. The General Comprehension scores were converted into grade-equivalent scores using the norms provided in the manual.

The Canadian Lorge-Thorndike Intelligence Test was marked by the researcher according to the keys provided by the publisher. Raw scores were computed for both the Verbal and Nonverbal batteries of the test. The raw scores were then converted into intelligence quotients using the

norms provided in the administration manual. A composite intelligence quotient was then computed for each subject.

Each subject's unaided recall on the SRIT was tape-recorded and then transcribed into a typed protocol. The SRIT protocols were then classified using three levels of dichotomous categories. The first level of analysis divided the subject's recall into inference/noninference responses. To be classed as an inference the subject's response had to generate new information not stated in the text. The following examples illustrate the use of the inference/noninference classification. Inferences are enclosed within parenthesis.

Subject 2: The story is Miss Bella's plan..uh. She was. She was...lived in the country. And she had a little cabin. And um she had some land. And she um ya ah. (And then she wanted to take up hunting.)...

Subject 25: Well um there was um. There was a fire. Whenever the dog wanted something he'd bark at his dish and he'd get some food and that stuff. When the cat comes along he'd bark at the cat (to frighten it away.). And then one night he was barking....

The second level involved the classification of the inferences as either forward-looking or backward-looking. Forward-looking inferences are those requiring the reader to use one or more explicitly stated ideas to go beyond that which is explicitly stated in the text. These inferences are not absolutely necessary to comprehend the text. Backward-looking inferences fill gaps between explicitly stated ideas and allow the reader to make sense of the explictly stated information. These inferences are necessary in order to comprehend the text. In the examples below,

forward-looking inferences are underlined with a broken line and backward-looking inferences are underlined with a solid line.

Subject 26: ...and then she waved the gun and then the hunter would leave quickly. Then fewer and fewer hunters seemed to come. And then one day there were no hunters at all. The birds were singing, animals were coming to her house....

Subject 32: ...And when it became hunting season um, she didn't want any of the animals on her farm to get killed or anything.

Subject 25: ...Then their house was on fire. So they um so they got out of their beds and ah they um went. They were crawling on their knees so the smoke won't choke you.

The third level involved the classification of the inferences as supported or nonsupported. For an inference to be classed as supported it had to be based on, and consonant with the explicitly stated information in the text. In the examples below the supported inferences have a "c" above them while nonsupported inferences are indicated by an "x" above them.

Subject 14: At the front of the story at the start it was ah about the dog mainly. Like well how (it couldn't see very good)^{x}.

Subject 20: Scotty he was a dog. And he saved his ah family on a fire. And he kept on barking (it must have been from the fire)^{c}.

Subject 32: (And when it became hunting season)^{c}.

Subject 26: The story was about a young lady who was born in cottage around Eastside Eastriver. (And she hunts or something like that)^{x}.

In order to check the reliability of the classification system used with the SRIT, six protocols were randomly selected by the investigator. These protocols were then checked by two independent judges who were

graduate students in reading. The Arrington Reliability Formula (Feifel and Lorge, 1950) was used to compute the reliability score

$$\left(\frac{2 \times \text{Total of Agreements}}{(2 \times \text{Total of Agreements}) + \text{Disagreements}} \right)$$

The reliability scores are indicated in Table 3.6.

Each subject's responses to the DQIT were tape-recorded and then transcribed into a typed protocol. Subject responses on the DQIT protocols were then classified in terms of their textual constraint. Those responses which were based on, and consonant with, the stimulus story were scored as correct and given one point. Responses which were not based on the stimulus story were given a zero. The following examples illustrate the use of the classification system. Examples for subjects twelve and thirty-three were considered to be textually constrained and were given one point. Examples for subjects fourteen and two were not textually constrained and were given a zero. In the examples below the researcher has been designated by "R" and the subject by "S".

Subject 12:

R: How long had the fire been burning when Scotty finally woke father?

S: Um...

R: How long had the fire been burning up until the time father realized what was going on?

S: Well he sat up and smelled smoke and um. Less than half an hour.

R: What makes you think that?

S: Cause um he said that Scotty was out less than an hour ago.

Subject 33:

R: Why did Scotty keep on barking even though Father ordered him to be quiet?

TABLE 3.6

RELIABILITY SCORES FOR SRIT SCORING SYSTEM

Levels	Investigator and Judge 1	Investigator and Judge 2	Judge 1 & Judge 2
Inference	.95	.96	.93
Forward-looking Inference	.96	1.00	.96
Backward-looking Inference	.95	.94	.92
Support	.95	.95	.90
Non-Support	.96	1.00	.96

S: Because the kitchen was on fire and the living room.

R: So why did he keep barking?

S: To wake them up. So like they, so they wouldn't be killed.

Subject 14:

R: Where does Scotty sleep at night?

S: Um, well, in the doghouse.

R: Where is the doghouse?

S: Outside in the backyard.

Subject 2:

R: How did the clerk feel when Miss Bella bought her gun and shells?

S: He felt alright. He was smiling and everything.

In order to check the reliability of the classification system used with the DQIT six protocols were randomly selected and checked by two independent judges who were graduate students in reading. The Arrington Reliability Formula was used to compute the reliability scores. These scores are indicated in Table 3.7.

The analysis used for the DQIT in the present study was a modification of McLeod's (1978) three-level classification system. The three-level system was reduced to one level in the present study as it proved difficult to make objective decisions at three levels. The three-level system also provided information beyond the scope of this study.

Analysis of the Data

The computer facilities in the Division of Educational Research Services at the University of Alberta were used to analyze the data from this study.

A one-way analysis of variance program (ANOV15) was used to determine whether there were significant differences among the groups on both the

TABLE 3.7

RELIABILITY SCORES FOR DQIT SCORING SYSTEM

	Investigator and Judge 1	Investigator and Judge 2	Judge 1 and Judge 2
Textually Constrained BLI	.98	.98	.97
Textually Constrained FLI	.98	1.00	.98
TOTAL	.98	.99	.98

independent and dependent variables in the study. Significance at the probability level of .05 was used as allowing acceptance of the null hypotheses. Where significant differences were found at the .05 level the Scheffé Multiple Comparison of Means was used to find where the significance lay.

Summary

A sample of twelve average grade four readers, twelve low grade six readers, and twelve average grade six readers were selected from one of the schools assigned to the researcher by the St. Albert Protestant Separate School District. The initial test population included eighty-four fourth-grade students and 138 sixth-grade students. The New Developmental Reading Test, Form A, and the Canadian Lorge-Thorndike Intelligence Test, Form 1, were used to screen subjects for inclusion in the sample.

Two reading inference tasks modified from McLeod (1978) were administered individually to each of the thirty-six subjects in the sample. All subjects' responses were tape-recorded and transcribed into typed protocols. from which they were analyzed. Inferences were first identified and then classified according to whether they were forward-looking or backward-looking and then further classified as to whether they were or were not textually constrained.

Statistical treatment of the data included one-way analysis of variance and Scheffé multiple comparison of means.

CHAPTER IV

FINDINGS AND DISCUSSION OF THE STUDY

The purpose of this study was to investigate differences in inferencing behavior among groups of average and low readers. This Chapter presents the findings of the study in relation to the null hypotheses generated in Chapter I and a discussion of these findings.

In order to organize the discussion of the findings, the inferencing behavior of the three reading groups will be presented in relation to findings from (1) the Story Recall Inference Task, and (2) the Directional Question Inference Task. A discussion of the findings will follow the presentation of findings on each inference task.

Findings Related to the Story Recall Inference Task

The Story Recall Inference Task (SRIT) was included in the study for the purpose of determining if the groups differed significantly in the number and type of inferences generated during an unaided recall of the written narrative discourse. Findings obtained from the SRIT were also examined to provide information on possible developmental aspects of inferencing behavior, as well as differences among average and low readers in their use of background knowledge and print for generating inferences.

A Comparison of the Quantity of Inferences Produced by the Three Reading Groups

In order to determine if there was a quantitative difference in the number of inferences generated by average fourth, low sixth, and average sixth-grade readers on an unaided recall task, Null Hypothesis 1 was formulated.

Null Hypothesis 1

> There is no significant difference among the three reading groups in terms of the quantity of inferences produced on the recall tasks.

Null Hypothesis 1 was tested using a one-way analysis of variance to compare the three groups of readers on the mean number of inferences generated during an unaided recall of a written continuous narrative discourse passage. The one-way analysis of variance results indicate that, while each group produced inferences, there was no significant difference among groups on the mean number of inferences generated for an unaided recall. A summary of this analysis is presented in Table 4.1. On the basis of these findings Null Hypothesis 1 was not rejected.

A Comparison of the Quantity of Forward-Looking Inferences Produced by the Three Reading Groups

In order to determine if there were significant differences among the three reading groups in terms of the number of forward-looking inferences generated on an unaided recall, Null Hypothesis 2 was formulated.

Null Hypothesis 2

> There is no significant difference among the three reading groups in terms of the quantity of forward-looking inferences produced on the recall task.

Due to the unstructured nature of the SRIT task, very limited data was provided by some of the subjects and there was considerable variation in the numbers of inferences reported within each of the groups. For this reason each subject's responses were converted into proportion scores. For example, subject #5 produced eight inferences in her unaided recall. Of these eight responses, three or 0.375 were backward-looking, and five or 0.625 were forward-looking.

TABLE 4.1

ANALYSIS OF VARIANCE: NUMBER OF INFERENCES PRODUCED ON AN UNAIDED RECALL (SRIT)

Source of Variation	Sum of Squares	Mean Squares	Degrees of Freedom	F-Ratio	Probability
Between Groups	1.722	.86	2	.13	.8825
Within Groups	226.583	6.87	33		

$F_{.95}(2,33) = 3.29$

The proportion scores were then used to test Null Hypothesis 2 by means of a one-way analysis of variance. The analysis indicated that, while each group made forward-looking inferences, there was no significant difference among groups on the mean proportion of forward-looking inferences generated on an unaided recall. A summary of this analysis is presented in Table 4.2. On the basis of these findings Null Hypothesis 2 was not rejected.

A Comparison of the Quantity of Textually Constrained Forward-Looking Inferences Produced by the Three Reading Groups

To determine if there were significant differences among the three reading groups in their ability to stay within textual constraints while making forward-looking inferences, Null Hypothesis 3 was formulated.

Null Hypothesis 3

> There is no significant difference among the three reading groups in terms of the quantity of textually constrained, forward-looking inferences produced on the recall task.

Again due to the unstructured nature of the SRIT task, each subject's responses were converted into proportion scores. For example, subject #5 produced five forward-looking inferences. Of these five inferences, four or 0.80 were within the constraints of the text while one or 0.20 of the responses were not textually constrained.

The proportions of textually constrained, forward-looking inferences were submitted to a one-way analysis of variance in order to test Null Hypothesis 3. Results of the analysis indicate that there were no significant differences among the groups on mean proportion scores on textually constrained, forward-looking inferences generated on the SRIT. A summary of this analysis is presented in Table 4.3. On the basis of these results, Null Hypothesis 3 was not rejected.

TABLE 4.2

ANALYSIS OF VARIANCE: PROPORTION OF ALL INFERENCES PRODUCED ON THE SRIT THAT WERE FORWARD-LOOKING

Source of Variation	Sum of Squares	Mean Squares	Degrees of Freedom	F-Ratio	Probability
Between Groups	4658.7695	2329.38	2	3.05	.06
Within Groups	25185.895	763.21	33		

$F_{.95}(2,33) = 3.29$

TABLE 4.3

ANALYSIS OF VARIANCE: PROPORTION OF FORWARD-LOOKING INFERENCES PRODUCED ON THE SRIT THAT WERE TEXTUALLY CONSTRAINED

Source of Variation	Sum of Squares	Mean Squares	Degrees of Freedom	F-Ratio	Probability
Between Groups	442.8437	221.42	2	.10	.908
Within Groups	76265.438	2311.07	33		

$F_{.95}(2,33) = 3.29$

A Comparison of the Quantity of Backward-Looking Inferences Produced by the Three Reading Groups

To determine if there were significant differences among the three reading groups in terms of the quantity of backward-looking inferences produced on an unaided recall, Null Hypothesis 4 was formulated.

Null Hypothesis 4

> There is no significant difference among the three reading groups in terms of the quantity of backward-looking inferences produced on the recall task.

As with Null Hypothesis 2, frequency counts were made and then converted into proportion scores. The proportion scores were used to test Null Hypothesis 4 by means of a one-way analysis of variance. The analysis indicated that there were significant differences at the .05 level among the groups in terms of mean proportion scores on backward-looking inferences produced on the SRIT. A summary of this analysis is presented in Table 4.4.

As this analysis indicated there was a significant difference at the .05 level among the three groups, the mean scores for each group (Table 4.5) were compared using the Scheffé Multiple Comparison of Means to find where this difference lay. A summary of the Scheffe analysis is presented in Table 4.6.

Table 4.6 indicates that the average grade six readers produced significantly more backward-looking inferences than did the average grade four group.

TABLE 4.4

ANALYSIS OF VARIANCE: PROPORTION OF ALL INFERENCES PRODUCED ON THE SRIT THAT WERE BACKWARD-LOOKING

Source of Variation	Sum of Squares	Mean Squares	Degrees of Freedom	F-Ratio	Probability
Between Groups	7732.062	3866.03	2	4.17	.02
Within Groups	30576.063	926.55	33		

$F_{.95}(2,33) = 3.29$

TABLE 4.5

GROUP MEAN PROPORTION SCORES FOR ALL INFERENCES PRODUCED ON THE SRIT THAT WERE BACKWARD-LOOKING

	Average Grade Four	Low Grade Six	Average Grade Six
Mean Score	50.633	67.983	86.525

TABLE 4.6

SCHEFFE MULTIPLE COMPARISON OF MEANS FOR PROPORTIONAL SCORES OF ALL INFERENCES PRODUCED ON THE SRIT THAT WERE BACKWARD-LOOKING

	Average Grade Four	Low Grade Six	Average Grade Six
Average Grade Four	-	.38	.02
Low Grade Six		-	.34
Average Grade Six			-

A Comparison of the Quantity of Textually Constrained Backward-Looking Inferences Produced by the Three Reading Groups

In order to determine if significant differences existed among the three reading groups in terms of producing textually constrained, backward-looking inferences, Null Hypothesis 5 was generated.

Null Hypothesis 5

> There is no significant difference among the three reading groups in terms of the quantity of textually constrained, backward-looking inferences produced on the recall task.

A one-way analysis of variance using proportion scores on textually constrained, backward-looking inferences was used to test Null Hypothesis 5. An examination of the results indicated that there were no significant differences among the groups. This analysis is summarized in Table 4.7, and on the basis of these results Null Hypothesis 5 was not rejected.

Discussion of Findings on the SRIT

The findings for Null Hypothesis 1 indicated that, while there were no significant differences among the groups in terms of the quantity of inferences produced on an unstructured situation, all groups did produce inferences (Table 4.8). The fact that all groups produced inferences supports the theoretical work of Gray (1960), Rystrom (1970), Ruddell (1972), Smith and Barrett (1974), and Carroll (1976), all of whom suggested that inferencing ability is one of the necessary subskills of comprehension. The results of the present study are also consistent with the research findings of Feder (1938), Davis (1968), and Pettit and Cockriel (1974) who showed that inferencing ability is one distinct subskill of the comprehension process.

TABLE 4.7

ANALYSIS OF VARIANCE: PROPORTION OF BACKWARD-LOOKING INFERENCES PRODUCED ON THE SRIT THAT WERE TEXTUALLY CONSTRAINED

Source of Variation	Sum of Squares	Mean Squares	Degrees of Freedom	F-Ratio	Probability
Between Groups	3285.50	1642.75	2	1.26	.296
Within Groups	42932.75	1300.99	33		

$$F_{.95}(2,33) = 3.29$$

TABLE 4.8

MEAN NUMBER OF INFERENCES PRODUCED ON THE SRIT BY THE THREE READING GROUPS

	Average Grade Four	Low Grade Six	Average Grade Six
Mean Score	3.75	4.16	3.66

Thorndyke (1976) showed that adults produce and store inferences as an integral part of their recall for prose. The present study supports this finding and suggests, along with Paris and Upton (1974) and McLeod (1978), that children also produce and store inferences when attempting to comprehend continuous narrative discourse.

An analysis of each group's unaided recalls also showed that subjects were able to produce the two types of inferences which Schank (1975) described as forward-looking and backward-looking. Each group produced and recalled both the essential backward-looking inferences which filled gaps between explicitly stated ideas, and nonessential forward-looking inferences which tied together one or more ideas and went beyond the explicitly stated information. The results of the unaided recalls thus lend credence to Schank's classification system.

Developmental Differences in Inferencing Behavior

The present study indicated that when the categories forward-looking, backward-looking and textual constraint were collapsed there were no significant developmental differences among the average grade four and the grade six groups. This finding was not in accord with that of the second Paris and Upton (1974) study which found significant developmental differences among kindergarten, grade two, and grade four groups. A possible explanation for this difference in findings may be the difference in samples used with the two studies. The present study used grade four and grade six subjects and may indicate that ability to make inferences levels off or plateaus as subjects reach the higher elementary grades. Further research using junior high grades needs to be conducted on an unstructured inferential task in order to confirm this hypothesis. Too, the difference in the presentation of the passages may have had an effect

on the subjects' responses. The Paris and Upton subjects had the passages read to them while subjects in the present study were required to read the passages silently.

When the frequency counts for inferences were converted into proportion scores and examined in terms of whether they were forward-looking or backward-looking, it was found that no significant developmental difference resulted on the quantity of forward-looking inferences produced. However, significant differences were found at the .02 level for the quantity of backward-looking inferences, with the average grade six group producing more of this category of inference than the average grade four group. This finding would appear to support the Paris and Upton (1974) findings until one adds the dimension of textual constraint. Paris and Upton did not count inferences which were extraneous elaborations or fabrications. When textual constraint was considered the present study found that no significant difference existed among the reading groups in terms of either textually constrained, forward-looking or backward-looking inferences.

Findings on the unstructured task indicated that both the average grade four and average grade six groups were able to produce and recall both types of inference, with each group producing both constrained and unconstrained inferences.

Differences Among Achievement Groups in Inferencing Behavior

The present study also investigated differences in inferencing behavior between average and low reading groups. When the two categories of forward-looking, backward-looking and constraint were collapsed it was found that no significant difference existed among the three groups. All three groups produced and recalled similar numbers of inferences as a part of their memory for written continuous narrative discourse.

Proportion scores for forward-looking inferences, backward-looking inferences, and textual constraint produced differences which were not significant. McLeod (1978), using very proficient and less proficient readers, also reported nonsignificant differences for both the collapsed and expanded classification categories.

While the present study indicated that inferencing behavior on an unstructured task did not differentiate average readers from low readers, it must be noted that all three groups did produce and recall inferences as an integral part of recall for written continuous narrative discourse. The present study suggests that low readers are as capable as average readers, in terms of inferencing behavior, when they are presented with material at their instructional level.

Within Group Trends

A statistical analysis of the means for within groups could not be carried out due to the limited size of each group, but an interesting pattern developed which is reported below. It was noted that all groups produced and recalled proportionately more backward-looking inferences than forward-looking inferences. It was also noted that all groups tended to produce more textually constrained than nonconstrained backward-looking inferences. For forward-looking inferences the reverse was true, with all groups producing more inferences that were not textually constrained.

These trends indicated that subjects in this study tended to use inferences to fill gaps more consistently than they did to expand the author's intended meaning. The higher mean number of backward-looking inferences may have resulted because backward-looking inferences are necessary to comprehension whereas forward-looking inferences are not as

crucial. The trends also suggested that subjects were more aware of the constraints placed on them by the text when filling gaps than when expanding or extending the author's explicit ideas.

Findings Related to the Directional Question Inference Task

The Directional Question Inference Task (DQIT) was included in this study to determine differences among the reading groups on answering forward-looking and backward-looking inference questions in a structured situation. The purposes were to determine possible developmental differences in inferencing behavior, and to determine whether the ability to generate inferences, in a structured situation, differentiates average readers from low readers.

A Comparison of the Quantity of Textually Constrained Forward-Looking Inferences Produced by the Three Reading Groups

To determine if significant differences existed among the three reading groups in terms of textually constrained, forward-looking inferences produced in a structured situation, Null Hypothesis 6 was formulated.

Null Hypothesis 6

> There is no significant difference among the three reading groups in terms of the quantity of textually constrained, forward-looking inferences produced on the direct questioning task.

A one-way analysis of variance was used to check Null Hypothesis 6. Results indicated that, while each group was able to correctly answer forward-looking inference questions, there were no significant differences among the groups on this variable. A summary of the analysis is presented in Table 4.9. As the statistical analysis indicated no significant differences, Null Hypothesis 6 was not rejected.

TABLE 4.9

ANALYSIS OF VARIANCE: NUMBER OF TEXTUALLY CONSTRAINED FORWARD-LOOKING INFERENCES PRODUCED ON THE DQIT

Source of Variation	Sum of Squares	Mean Squares	Degrees of Freedom	F-Ratio	Probability
Between Groups	1.722	.86	2	.89	.420
Within Groups	31.916	.97	33		

$F_{.95}(2,33) = 3.29$

A Comparison of the Quantity of Textually Constrained Backward-Looking Inferences Produced by the Three Reading Groups

In order to determine significant differences among the three reading groups on the production of textually constrained, backward-looking inferences produced on a structured inferencing task, Null Hypothesis 7 was formulated.

Null Hypothesis 7

> There is no significant difference among the three reading groups in terms of the quantity of textually constrained, backward-looking inferences produced on the direct questioning task.

The Null Hypothesis was tested using a one-way analysis of variance. Results indicated no significant differences among the groups in terms of the quantity of textually constrained, backward-looking inferences produced. Therefore, Null Hypothesis 7 was not rejected. A summary of the analysis to test Null Hypothesis 7 is presented in Table 4.10.

Discussion of Findings on the DQIT

Results on the DQIT were sought in order to determine differences in inferencing behavior among reading groups on a structured inference task.

As with results for the unstructured task, it was found that while no significant differences existed among the groups, all groups were able to make inferences. These findings provide additional support for the theoretical work of Gray (1960), Rystrom (1970), Ruddell (1972), Smith and Barrett (1974), and Carroll (1976), and the research findings of Feder (1938), Davis (1968), and Pettit and Cockriel (1974) all of whom identified inferencing ability as a necessary subskill of comprehension.

TABLE 4.10

ANALYSIS OF VARIANCE: NUMBER OF TEXTUALLY CONSTRAINED BACKWARD-LOOKING INFERENCES PRODUCED ON THE DQIT

Source of Variation	Sum of Squares	Mean Squares	Degrees of Freedom	F-Ratio	Probability
Between Groups	5.555	2.78	2	2.86	.071
Within Groups	32.000	.97	33		

$F_{.95}(2,33) = 3.29$

Developmental Differences in Inferencing Behavior

Paris and Upton (1974) found that subjects showed an improvement with age in their ability to comprehend inferential relations. The present study indicated there were no significant developmental differences between fourth and sixth-grade readers in terms of textually constrained, forward-looking or backward-looking inference questions. A possible explanation of this difference in results may be due, as with the differences on the unaided recall, to the levelling off or plateauing of the influence of the developmental factor as subjects reach the higher elementary grades. Paris and Upton noted that the main difference occurred between the two youngest groups - kindergarten and grade one.

As well, the nature of the task may have caused differences in results. For the Paris and Upton study, subjects were required to respond "yes" or "no" to an inferential statement. The present study required a different processing procedure, in that subjects were required to produce answers to inferential questions. The fact that subjects produced answers on one task and confirmed statements on the other task may have required different cognitive abilities.

Paris and Upton had passages read to their subjects, while subjects in the present study were required to read the passages silently. This difference in presentation may have had an effect on the results, as the Paris and Upton subjects would not have been able to reread or refer back to the text in order to confirm their responses.

Differences Among Achievement Groups in Inferencing Behavior

Research by McLeod (1978) indicated that significant differences existed between very proficient and less proficient readers at the grade four level on answering inferential questions. These differences were

found for both forward-looking and backward-looking inferential questions. The present study did not support the McLeod findings. Subjects in all groups of the present study demonstrated an ability to provide acceptable answers for both forward-looking and backward-looking inferential questions, but an examination of the means for the groups indicated that, while there were differences among the groups in favor of the average groups, the differences were not significant (Table 4.11).

One or more of the following circumstances may have contributed to the difference in findings between the McLeod (1978) study and the present study. The McLeod study used two groups of grade four subjects, while the present study used grade four and grade six subjects. The greater potential background knowledge of the low grade six group may have enabled them to achieve at a level commensurate with that of the average grade four group.

The time spent completing the various inferential tasks may also have been a factor. McLeod's subjects completed an additional inferential task, and were also required to provide textual support for their responses. The present study involved each subject for a shorter period of time and only required one reading of the story. It is possible that low readers attend more efficiently when the duration of the task is shortened.

Within Group Trends

As with the SRIT, statistical analysis was not carried out due to the limited numbers of subjects in each group. It was interesting to note, however, that all groups tended to score higher on the backward-looking than forward-looking inferential questions. This suggests that subjects, as on the SRIT, were better able to infer for the purpose of filling gaps than for the purpose of expanding the author's explicit ideas.

TABLE 4.11

MEAN PERCENTAGE SCORES FOR THE THREE GROUPS ON THE DQIT

	Average Grade Four	Low Grade Six	Average Grade Six
Mean Score on Forward-Looking Inference Questions	68	60	70
Mean Score on Backward-Looking Inference Questions	82	66	82

Summary

The inferencing behavior of average and low readers was analyzed in terms of Schank's (1975) classification system. This system involved separating inferences into two categories: (1) forward-looking, and (2) backward-looking, as well as rating the responses in terms of textual support. Subject's inferential behavior was analyzed on both an unstructured and a structured task.

Findings on the unstructured situation indicated that inferencing behavior did not discriminate between the average readers and the low readers. A significant developmental difference was indicated for the quantity of backward-looking inferences, but no significant difference was indicated for the other variables measured. Analysis indicated that all groups were able to produce and store inferences as an integral part of their memory of the stories.

Findings on the structured situation indicated that neither developmental nor achievement differences were significant. It was found that all groups attained some measure of success with the inferential question task.

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

This chapter will present a summary of the study, the main findings, and conclusions. Implications for the teaching of reading and suggestions for further research will also be presented.

Summary of the Study

The purposes of this study were to investigate the developmental and process differences in inferencing behavior among average and low readers.

The sample consisted of thirty-six subjects drawn from the St. Albert Protestant Separate School District. Subjects were selected on the basis of comprehension scores on the New Developmental Reading Test, Form A (1968), and combined scores on the Canadian Lorge-Thorndike Intelligence Test, Form 1 (1967). Subjects formed three equal sized groups: (1) average grade four, (2) average grade six, and (3) low grade six readers.

Each subject was tested individually by the researcher using two inferential reading tasks developed by McLeod (1978). The first task had pupils read a narrative passage and provide an unaided recall. The second task required subjects to answer ten inferential questions based on the passages from the first task.

The unaided recalls were tape-recorded and later transcribed into typed protocols for analysis according to categories developed by Schank.

The data were analyzed using a one-way analysis of variance followed by a Scheffé multiple comparison of means.

Main Findings

An analysis of the data yielded several main findings.

1. All subjects were able to produce and recall inferences as part

of an unaided recall. No significant differences due to development or level of reading proficiency were evident in quantity of inferences produced by the three reading groups.

2. No significant differences were found among the age or reading proficiency groups on the production of forward-looking inferences on the recall tasks.

3. Significant differences were not indicated for the quantity of textually constrained, forward-looking inferences produced on the recall task. All groups produced both constrained and unconstrained inferences. It was noted that all groups tended to produce more unconstrained than constrained forward-looking inferences.

4. Significant developmental differences were indicated between the average grade four and the average grade six groups on the quantity of backward-looking inferences produced on a recall task. No significant process differences were found between average and low reading groups on this variable.

5. Textual constraint for backward-looking inferences indicated no significant differences among the three reading groups. Each group produced similar numbers of textually constrained, backward-looking inferences.

6. Analysis of the mean performance for the three groups indicated no significant differences when responding to both forward-looking or backward-looking inference questions. This suggested that all groups were capable of producing inferential responses on a structured task.

General Conclusions

The following conclusions were drawn on the basis of the findings in this study.

1. Both average and low readers at the upper elementary level produce, store, and recall inferences as an integral part of their recall for written continuous narrative discourse.

2. Both average and low readers are able to answer inferential questions when material is presented at or below their instructional reading level.

3. Inferences may be analyzed using Schank's (1975) categories of forward-looking and backward-looking, and may be qualitatively analyzed in terms of textual constraint.

4. There are no significant differences in inferencing behavior between average and low readers for either a structured or unstructured situation.

5. Average grade six readers produce more backward-looking inferences, than do average fourth-grade readers but developmental factors level off or plateau for forward-looking inferences and use of textual constraint.

Limitations

In addition to those limitations cited in Chapter I, the following limitations became apparent during the progress of the study.

1. The unstructured nature of the recall task resulted in considerable variation among the subjects on the quantity of inferential responses produced. Inferential responses ranged from a total of eleven to zero on the recall, and this variance may have affected the reliability of scores on the unstructured task.

2. The present study examined inferential responses for only one passage. Had subjects been presented with more passages the data may have yielded more reliable results.

3. The present study used only one classification system (Schank, 1975) for categorizing inferential responses. Had a different system such as that of Smith and Barrett (1974) or Paris and Upton (1974) been used differences may have resulted among the groups.

4. Generating ten inferential questions for each story necessitated inclusion of some questions which had limited use as discriminators among groups.

Implications of the Study

The findings of this study suggest a number of implications for the teaching of reading.

1. Significant differences were not found in the inferential behavior of average and low readers when materials were presented at or below the reader's instructional reading level. This indicates that regardless of achievement level readers at the upper elementary grades can carry out the processes necessary to produce inferences when the reading material is at an appropriate instructional level. It is thus crucial, if inferential behavior is to occur, that classroom teachers and clinicians be aware of both the student's instructional and frustration levels in order to provide materials at instructional reading level.

2. The study indicated that low readers can produce inferences. This suggests that many of the present remedial reading programs, with their heavy emphasis on word identification and literal comprehension, should be modified to reinforce and extend the developing inferential skills possessed by low readers. It would appear that inferential comprehension may be taught concurrently with literal comprehension.

3. All groups produced, stored, and recalled inferences as an integral part of their recall for a passage. This suggests that teachers and

clinicians should not expect a rote recall for a story when they request an unaided recall. Children store inferences as a part of their memory for discourse and teachers need to accept inference as a natural, even expected occurrence, if a child has comprehended a passage.

4. This study shows that pupils at grades four and six produce inferences. Thus, teachers at the upper elementary levels need to ensure that they include questions at the inferential level in their reading program. This will allow pupils to reinforce inferential skills and make them aware of the active part they must take if comprehension is to occur. Teachers must strive for quality responses by having pupils support their inferences with the text. Having pupils justify their responses with the text will aid them to realize that the text places certain constraints upon inferential responses. Teachers also need to examine published materials for their inclusion of inferential questions. McLeod (1978) has reported a great discrepancy among published materials in this area of comprehension. Teachers should ensure that they supplement published materials which place a heavy emphasis on literal level responses.

5. This study lent support for the psychological reality of forward-looking and backward-looking inferences. Thus, teachers should help pupils become aware that some inferences fill gaps between explicitly stated ideas and are essential for understanding, while others are not essential but provide for deeper understanding of the author's message. Opportunities need to be provided that allow pupils to be exposed to, and work with, both types of inferences. Work in this area should help lead pupils to an awareness of the constructive nature of the comprehension process.

Suggestions for Further Research

The following suggestions are made for further research into children's inferential behavior.

1. The discussion of findings presented in Chapter IV indicated that a discrepancy exists between findings on the present study and studies conducted by Paris and Upton (1974), regarding the role played by development on inferencing behavior. For this reason it is suggested that the present study be replicated using subjects from other grade levels in order to explore further the developmental aspects of inferencing behavior. Developmental aspects could also be examined by conducting a longitudinal study following groups of readers through the elementary and junior high grades.

2. The present study used only narrative material. Other studies need to be conducted using different types of reading material. Reading instruction, prior to and at the upper elementary grades, exposes pupils to primarily narrative material. As pupils advance to the higher grades they are required to read increasing amounts of expository material. Information regarding inferential behavior on expository material would prove useful to classroom teachers.

3. The present study used a limited number of subjects and needs to be replicated using a larger sample in order to confirm the present findings. Larger numbers in each group would provide greater reliability for findings and allow for statistical analysis of findings within groups.

4. A study could be conducted to investigate the inferential behavior of subjects using a classification other than Schank's (1975). Use of an alternate classification system such as Smith and Barrett's (1974)

which suggests eight types of inference may indicate significant differences among group's inferential responses. If significant differences were shown to exist it would suggest implications other than those presented for the present study.

5. The present study examined the production of inferences on an unaided recall. No attempt was made to examine literal recall of ideas presented in the stories in order to determine differences among low and average readers on the quantity of stimulus information recalled. A study could be conducted which counts the number of ideas in the stimulus passage and then compares the number of ideas recalled on an unaided recall. The study should compare the number of ideas low and average readers recall and examine the relationship between rote recall and inferencing behavior. This would investigate differences between low and average readers in the use of inference to aid recall and comprehension.

Concluding Statement

Research and theory suggests that comprehension is a multifaceted, cognitive process. Much of the literature suggests that an ability to infer beyond the explicitly stated information is important if one is to comprehend an author's intended message. This means that the reader must be able to integrate his background knowledge with the print if he is to draw inferences.

This study investigated possible developmental factors in inferencing behavior and attempted to determine differences among ability groups on inferencing behavior.

The findings suggested that average and low readers had similar inferential behaviors. This suggested that both average and low readers

produce and store inferences as an integral part of their recall for written continuous narrative discourse.

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APPENDIX A

CONTINUOUS NARRATIVE DISCOURSE PASSAGES

MISS BELLA'S PLAN

Miss Bella lived by herself in a little white cottage. It was on a small farm by the highway between Riverside and Treesdale. She had lived there ever since she was born, more than seventy years ago.

She was very fond of the wild animals and birds that lived in the woods and fields on her farm. Although her fondness of wild animals was not well known, her kindness toward other people was. Whenever sickness struck one of the homes of the neighbours, Miss Bella was there to help.

The days came when the leaves on the trees changed colour. Then the sounds of shots echoed through the woods on Miss Bella's farm. She shuddered with each report. Which one would be lost today? Would it be the red squirrel, or the brown rabbit? Or would it be the brightly coloured pheasant? She quickly put on her coat and went out to warn away the unwelcome visitors. They certainly had paid no attention at all to the large NO HUNTING signs along her fences.

The next day Miss Bella went to Riverside to shop. Her first stop was the hardware store. "I've decided to take up hunting," she smilingly told the young clerk. She asked to see a shot gun. The barrel shook like a leaf in her old hands. Miss Bella squinted through her thick glasses over the sights. "I've been over to Treesdale, and I've purchased my permit to hunt. All I need now is a gun and some shells. Then I'll be ready to have some fun." The young clerk wiped his forehead with the back of his hand.

The news that Miss Bella had taken up hunting spread quickly to all the local folk. The fellows at the service station told the visiting hunters who stopped for gas about Miss Bella's new interest. "I wouldn't go out to her farm to hunt. She is so nearsighted she would shoot

anything that moved."

Shortly after Miss Bella bought her gun, she noticed that fewer hunters came to her farm. Still each day she would take the gun, and walk across the field to the woods. There she would fire two or three blasts into the mud bank of the little creek. If she ever saw a visiting hunter, she would squint through her glasses at him. Then she would wave her gun in his direction, as though she had mistaken him for game. Whenever this happened, the hunter was quick to leave.

Finally no hunters came. For the remaining warm days peace and quiet returned to Miss Bella's farm. The birds sang happily overhead as they gathered in flocks, and on the ground the small animals prepared for winter.

SCOTTY BECOMES A HERO

Scotty was the Brown's pet terrier. Although he couldn't talk he let everyone know what he wanted. If he wanted outside, he went to the door and barked sharply. When he was hungry, he would go to his dish and bark until someone came to feed him. He even showed his dislike for the neighbour's cat by barking furiously at it whenever it happened to appear. But this barking tonight was too much. It was the middle of the night, and if Scotty kept on, he would waken every member of the Brown family.

"Quiet Scotty," ordered Father from the comfort of his bed. "You can't be hungry, and you were out less than an hour ago. You don't need out right now." Father tried to settle back to sleep, but Scotty kept on barking. Then he bounded up the stairs, raising a terrible racket all the way. Sitting up quickly Father called, "I smell smoke! Get up everyone!"

Mother scrambled out of bed. "Hurry! The house is on fire!"

Father shouted to the children as he rushed into the hall, "Jerry! Cindy! Come quickly! You'll have to stay close to the floor so that the smoke will not choke you. Scotty will lead us out if we follow him."

As the children ran into the hall, Scotty was already on the stairs. Jerry and Cindy followed Scotty down the steps. Their eyes burned with the smoke. It choked them too, and it made it very hard to breathe. They could see the flames in the kitchen and in the living room. The floor and the walls were all ablaze. The heat was deadly. Finally they reached the front door. Jerry reached for the door handle. It was very hot, but he finally got it open. They were met by the cold night air as they stumbled onto the lawn.

Bells clanged, and men were shouting orders as three fire engines

roared to a stop in front of their house. In minutes they had unwound the hoses, and were spraying the flames with strong steady streams of water. The children huddled together as they watched the firemen trying to save their house. At last the flames were out, and only smoke and steam could be seen coming from the broken windows. A lot of damage had been done to the house, but it could be repaired. The most important thing was that Father, Mother, Jerry, and Cindy were all safe.

Cindy put her arms around the little terrier. "You saved us Scotty."

"You're a brave dog," Jerry added, patting Scotty's head.

"You can bark as much as you want, anytime you want. We owe our lives to you," put in Father.

APPENDIX B

FORWARD-LOOKING AND BACKWARD-LOOKING INFERENCE QUESTIONS USED FOR THE DQIT

Backward-looking Inference Questions used with "Miss Bella's Plan"

1. How did Miss Bella feel when she first heard the hunter's gunshots?
2. How did the clerk feel when Miss Bella bought her gun and shells?
3. Why did Miss Bella go out and fire two or three shots into the bank of the creek each day?
4. Why did the hunters stop coming to Miss Bella's farm?
5. Why did the news that Miss Bella had taken up hunting spread quickly to the local folk?

Forward-looking Inference Questions used with "Miss Bella's Plan"

1. During what season does this story take place? Explain.
2. Why did few people know about Miss Bella's fondness for animals?
3. Why did the hunters come to Miss Bella's farm to hunt?
4. Why did the hunters ignore the NO HUNTING signs?
5. What will Miss Bella do if the hunters return next year?

Backward-looking Inference Questions used with "Scotty Becomes A Hero"

1. How did Father feel toward Scotty at the beginning of the story?
2. Where were the bedrooms in the Brown's home?
3. Why did Scotty keep on barking even though Father ordered him to be quiet?
4. Where does Scotty sleep at night?
5. How did Father feel about Scotty's barking at the end of the story?

Forward-looking Inference Questions used with "Scotty Becomes A Hero"

1. Why didn't Father pay attention to Scotty's barking at first?
2. Why was Scotty able to lead the children to safety?

3. How long had the fire been burning when Scotty finally awakened Father? Explain.
4. Why were the children huddled together on the lawn as they watched the men work?
5. In what kind of community could this story have taken place?

APPENDIX C

DIRECTIONS TO STUDENTS FOR THE TWO INFERENTIAL TASKS

SRIT

I'd like you to read this story to yourself. When you are finished I'd like you to tell me about the story. Pretend that I'm a friend who hasn't read this story and you're going to tell me about it so I won't have to read it - just like you'd do if you saw a certain T.V. show last night that I didn't, and now you're going to tell me about it.

[After unaided recall]

Is that what you remember?

DQIT

Here's the story back in case you want to look at it in order to answer the questions.

[Questions]

Thank you.

APPENDIX D

SUBJECTS' SCORES ON DQIT AND SRIT

AVERAGE GRADE FOUR SUBJECTS' SCORES
ON DQIT AND SRIT

Subject	DQIT*		SRIT**			
	FLI***	BLI****	FLI	FLI CON-STRAINED	BLI	BLI CON-STRAINED
1	4	4	18.2	0	81.8	66.7
2	4	5	0	0	100.0	100
3	4	5	50	0	50	100
4	4	4	0	0	0	0
5	4	3	62.5	80	37.5	66.7
6	4	5	0	0	100	100
7	3	3	40	50	60	0
8	4	4	75	66.7	25	100
9	4	4	0	0	100	100
10	1	4	80	75	20	100
11	3	5	100	100	0	0
12	2	4	66.7	100	33.3	100

*DQIT -- scores are raw scores out of five

**SRIT -- scores are proportion scores

***FLI -- Forward-looking inference

****BLI -- Backward-looking inference

LOW GRADE SIX SUBJECTS' SCORES
ON DQIT AND SRIT

Subject	DQIT*		SRIT**			
	FLI***	BLI****	FLI	FLI CON-STRAINED	BLI	BLI CON-STRAINED
13	3	3	50	100	50	100
14	1	1	0	0	100	50
15	4	4	0	0	0	0
16	2	2	37.5	0	62.5	20
17	4	4	0	0	100	50
18	4	4	20	100	80	75
19	4	5	0	0	100	100
20	3	2	16.7	100	83.3	60
21	4	3	25	100	75	66.7
22	2	5	60	100	40	50
23	3	2	75	0	25	0
24	2	5	0	0	100	75

*DQIT -- scores are raw scores out of five

**SRIT -- scores are proportion scores

***FLI -- Forward-looking inference

****BLI -- Backward-looking inference

AVERAGE GRADE SIX SUBJECTS' SCORES
ON DQIT AND SRIT

Subject	DQIT*		SRIT**			
	FLI***	BLI****	FLI	FLI CON-STRAINED	BLI	BLI CON-STRAINED
25	5	4	0	0	0	100
26	4	4	20	100	80	100
27	3	3	0	0	100	100
28	3	4	25	0	75	100
29	3	5	0	0	100	66.7
30	3	5	16.7	100	83.3	80
31	4	4	0	0	100	75
32	4	3	50	0	50	0
33	3	4	0	0	100	50
34	5	4	25	100	75	66.7
35	2	5	0	0	100	100
36	3	5	25	100	75	83.3

*DQIT -- scores are raw scores out of five

**SRIT -- scores are proportion scores

***FLI -- Forward-looking inference

****BLI -- Backward-looking inference